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PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Ap licant: Gruber
Se al No.: 10/633,214
Fil ıg Date: August 1, 2003
Co firmation No.: 3243

Examiner: Wesner Sajous
Art Unit: 2676
Docket No.: 00100.02.0058

Tit :: **METHOD AND APPARATUS FOR INTERPOLATING PIXEL PARAMETERS BASED ON A PLURALITY OF VERTEX VALUES**

Ma l Stop Amendment
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Date *Barbara G. Hannon*

DRAFT AMENDMENT
FOR PURPOSES OF DISCUSSION ONLY
NOT TO BE ENTERED

De: Sir:

In response to the non-final Office Action mailed December 15, 2004, Applicants submit the ollowing response.

Amendments to the Specification begin on page 2 of this paper.

Amendments to the Claims begin on page 2 of this paper.

Remarks begin on page 14 of this paper.

Claim 1 (currently amended): A method for interpolating pixel parameters based on a plurality of vertex values, the method comprising:

while in a setup mode, generating a plurality of differential geometric values based on the plurality of vertex values, wherein the differential geometric values are independent of a parameter slope between the plurality of vertex values;

while in a calculation mode, for each of a plurality of pixels:

determining a first geometric value and a second geometric value based on a pixel value, the plurality of vertex values and the differential geometric values; and

determining ~~a~~ an interpolated pixel parameter value for each of the plurality of pixels based on a vertex parameter value, the first geometric value and the second geometric value.

Claim 2 (original): The method of claim 1 further comprising:

while in the setup mode, writing the plurality of differential geometric values to a temporary buffer; and

while in the calculation mode, reading the plurality of differential geometric values from the temporary buffer for the calculation of the interpolated pixel parameter value for each of the plurality of pixels.

Claim 3 (currently amended): The method of claim 1 wherein the interpolated pixel parameter value is further determined based on the first geometric value adjusted by a first differential value and the second geometric value ~~is~~ adjusted by a second differential value.

4. The method of claim 3 wherein the plurality of vertex values includes a first vertex value, a second vertex value and a third vertex value.

5. The method of claim 4 wherein the step of determining the interpolated pixel parameter value further comprises:

combining the first vertex value, the first geometric value adjusted by the first differential value and the second geometric value adjusted by the second differential value.

6. The method of claim 4 wherein the plurality of differential geometric values includes a first differential geometric value and a second differential geometric value, the step of generating the first geometric value includes:

determining the sum of the product of a first difference and the first differential geometric value and the product of a second difference and the second differential geometric value, wherein:

the first difference is the difference between a first_plane pixel parameter and a first_plane zero_vertex parameter;

the first differential geometric value is the difference between a second_plane zero_vertex parameter and a second_plane second_vertex parameter;

the second difference is the difference between the second_plane pixel parameter and a second_plane zero_vertex parameter; and

the second differential geometric value is the difference between the first_plane zero_vertex parameter and a first_plane second_vertex parameter.

7. The method of claim 6 wherein the plurality of differential geometric values inc udes a third differential geometric value, the step of generating the second geometric value inc udes:

determining the sum of the product of the first difference and the third differential geometric value and the product of the third difference and the fourth differential geometric value, wherein:

the third differential geometric value is the difference between a second_plane first_vertex parameter and the second_plane zero_vertex parameter; and

the fourth differential geometric value is the difference between a first_plane first_vertex parameter and the first_plane zero_vertex parameter.

8. The method of claim 7 wherein the first differential value is the difference bet /een a second vertex value and the first vertex value, the difference divided by a twice_area val e and the second differential value is the difference between a third vertex value and the first ver ex value, the difference divided by a twice_area value.

9. The method of claim 8 wherein the twice_area value is a difference between a prc luct of a difference between the first_plane second_vertex parameter and the first_plane zer _vertex parameter and a difference between the second_plane first_vertex parameter and the sec nd_plane zero_vertex parameter and a product of a difference between the first_plane zer _vertex parameter and the first_plane first_vertex parameter and a difference between the sec nd_plane zero_vertex parameter and the second_plane second_vertex parameter.

10 (currently amended): An apparatus for interpolating pixel parameters based on a plurality of vertex values, the apparatus comprising:

a processor;

a temporary buffer operably coupled to the processor; and

a memory operably coupled to the processor, the memory storing a plurality of executable instructions such that the processor, in response to the executable instructions:

while in a setup mode, generates a plurality of differential geometric values based on the plurality of vertex values, wherein the differential geometric values are independent of a parameter slope between the plurality of vertex values;

while in a calculation mode, for each of a plurality of pixels:

determines a first geometric value and a second geometric value based on a pixel value, the plurality of vertex values and the differential geometric values; and

determines ~~a~~ an interpolated pixel parameter value for each of the plurality of pixels based on a vertex parameter value, the first geometric value and the second geometric value.

11 (currently amended): The apparatus of claim 10 wherein the processor, in response to the executable instructions:

while in the setup mode, writes the plurality of differential geometric values to a temporary buffer; and

while in the calculation mode, reads the plurality of differential geometric values from the temporary buffer for the calculation of the pixel value for each of the plurality of pixels.

12. The apparatus of claim 10 wherein the processor, in response to the executable ins uctions, determines the interpolated pixel parameter value based on the first geometric value adj sted by a first differential value and the second geometric value adjusted by a second dif erential value.

13. The apparatus of claim 12 wherein the processor, in response to the executable ins uctions further includes determining the interpolated pixel parameter value by summing the ver ex parameter value, the first geometric value adjusted by the first differential value and the sec nd geometric value adjusted by the second differential value.

14. The apparatus of claim 12 wherein the processor, in response to the executable ins uctions determines the first differential value as the difference between a second vertex val e and a first vertex value, the difference divided by a twice_area value and the second dif erential value is the difference between a third vertex value and the first vertex value, the dif erence divided by the twice_area value.

15 (currently amended): The apparatus of claim ~~13~~14 wherein the twice_area value is : difference between a product of a difference between a first_plane second_vertex parameter an a first_plane zero_vertex parameter and a difference between a second_plane first_vertex

parameter and a second_plane zero_vertex parameter and a product of a difference between a first_plane zero_vertex parameter and a first_plane first_vertex parameter and a difference between the second_plane zero_vertex parameter and a second_plane second_vertex parameter.

16. The apparatus of claim 10 wherein the processor, in response to the executable instructions:

generates the first geometric value by the sum of the product of a first difference and a first differential geometric value and the product of a second difference and a second differential geometric value, wherein:

the first difference is the difference between a first_plane pixel parameter and first_plane zero_vertex parameter;

the first differential geometric value is the difference between a second_plane zero_vertex parameter and a second_plane second_vertex parameter;

the second difference is the difference between the second_plane pixel parameter and a second_plane zero_vertex parameter; and

the second differential geometric value is the difference between the first_plane zero_vertex parameter and a first_plane second_vertex parameter; and

generates the second geometric value the sum of the product of the first difference and a third differential geometric value and the product of the third difference and a fourth differential geometric value, wherein:

the third differential geometric value is the difference between a second_plane first_vertex parameter and the second_plane zero_vertex parameter; and

the fourth differential geometric value is the difference between a first_plane first_vertex parameter and the first_plane zero_vertex parameter.

17. The apparatus of claim 10 further comprising:

a shader operably coupled to the processor such that the shader is capable of receiving the plurality of pixels and generates a plurality of display pixels; and

a frame buffer coupled to the shader such that the frame buffer receives the plurality of display pixels therefrom.

18. A method for interpolating pixel parameters based on a plurality of vertex values, the method comprising:

receiving a zero vertex valuc;

receiving a first vertex value;

receiving a second vertex value;

generating a first differential geometric value and a second differential geometric value in relation to the zero vertex value and the second vertex value, wherein the first differential geometric value and the second differential geometric value are independent of a parameter slope between the zero vertex value and the second vertex value;

generating a third differential geometric value and a fourth differential geometric value in relation to the first vertex value and the second vertex value, wherein the third differential geometric value and the fourth differential geometric value are independent of a parameter slope between the first vertex value and the second vertex value;

writing the first geometric value and the second geometric value to a temporary buffer.

19. The method of clam 18 wherein the zero vertex value includes a first_plane zero_vertex parameter and a second_plane zero_vertex parameter, the first vertex value includes a first_plane first_vertex parameter and a second_plane first_vertex parameter, and the second vertex value includes a first_plane second_vertex parameter and a second_plane second_vertex parameter.

20. The method of claim 18 further comprising:

reading the first differential geometric value and the second differential geometric value from the temporary buffer; and

on a pixel by pixel basis, determining a pixel value for each of a plurality of pixels based on a vertex parameter value, a first geometric value and a second geometric value, wherein the first geometric value and the second geometric value are determined based on the first differential geometric value, the second differential geometric value, the third differential geometric value and the fourth differential geometric value.

21 (currently amended): The method of claim ~~21~~20 wherein the step of determining the pixel value further includes the pixel value based on a first differential value and a second differential value.

22. The method of claim 21 wherein the pixel value is determined based on the product of the first differential value and the first geometric value combined with the product of the second differential value and the second geometric value combined with the vertex parameter value.

23 (currently amended): A method for interpolating pixel parameters based on a plurality of vertex values, the method comprising:

operating in a setup mode and while in a setup mode:

generating a plurality of differential geometric values for the plurality of vertex values based on a zero vertex value, a first vertex value and a second vertex value, wherein the plurality of differential geometric values are independent of a parameter slope between the plurality of vertex values;

writing the plurality of differential geometric values to a temporary buffer; and

switching to a calculation mode and while in a calculation mode:

reading the plurality of differential geometric values from the temporary buffer; and

determining ~~a~~ an interpolated pixel parameter value for each of a plurality of pixels based on a first geometric value adjusted by a first differential value and the second geometric value adjusted by a second differential value such that the interpolated pixel parameter value is determined based on the product of the first differential value and the first geometric value combined with the product of the second differential value and the second geometric value combined with the first vertex value, wherein the first geometric value and the second geometric value are determined with respect to the plurality of differential geometric values.

24. The method of claim 23 wherein the step of generating the first geometric value includes:

determining the sum of the product of a first difference and a first differential geometric value and the product of a second difference and a second differential geometric value, wherein:

the first difference is the difference between a first_plane pixel parameter and first_plane zero_vertex parameter;

the first differential geometric value is the difference between a second_plane zero_vertex parameter and a second_plane second_vertex parameter;

the second difference is the difference between the second_plane pixel parameter and a second_plane zero_vertex parameter; and

the second differential geometric value is the difference between the first_plane zero_vertex parameter and a first_plane second_vertex parameter; and

determining the sum of the product of the first difference and a third differential geometric value and the product of the third difference and a fourth differential geometric value, wherein:

the third differential geometric value is the difference between a second_plane first_vertex parameter and the second_plane zero_vertex parameter; and

the fourth differential geometric value is the difference between a first_plane first_vertex parameter and the first_plane zero_vertex parameter.

25. The method of claim 24 wherein the first differential value is the difference between a second vertex value and the first vertex value, the difference divided by a twice_area value and the second differential value is the difference between a third vertex value and the first vertex value, the difference divided by a twice_area value.

26. The method of claim 25 wherein the twice_area value is a difference between a pro luct of a difference between the first_plane second_vertex parameter and the first_plane zer _vertex parameter and a difference between the second_plane first_vertex parameter and the sec nd_plane zero_vertex parameter and a product of a difference between the first_plane zer _vertex parameter and the first_plane first_vertex parameter and a difference between the sec nd_plane zero_vertex parameter and a second_plane second_vertex parameter.

REMARKS

Claims 1-26 are pending in the present application. Of this claims, 1-17 and 23-26 stand rej :ted. The Applicants respectfully traverse these rejections as will be explained below. The Ap licants thank the Examiner for indicating that claims 18-22 are allowed.

In light of the following remarks, Applicants respectfully traverse the objections and rej :tions in the present Office Action and request reconsideration.

Claims 11, 15, and 21 were objected to due to noted informalities concerning claimed dep ndencies. The amendments to these claims are believed to address and resolve these obj ctions.

Claims 1-17 were rejected under 35 U.S.C. § 112, second paragraph, as being indefinite. In articular, independent claims 1 and 10 due to the inclusion of "a pixel value" in two ins nces. The amendments to these claims are believed to obviate this rejection. In particular, it is n ted that the second instance of the claimed "a pixel value" has been amended to read "an int polated pixel parameter value." Support for this amendment may be found, for example, in par graph 17, which discusses that based on various vertex parameters, a particular pixel par meter is calculated. Further support for this amendment may also be found in paragraph 32, wh :h discusses that the disclosed method of FIG. 2, as an example, improves other prior int polating pixel parameter techniques. Moreover, paragraph 31 of the present specification cle rly indicates that the method repeats for each pixel value until all pixel parameters are cal ulated. Accordingly, no new matter is believed to be added by this amendment.

Claims 3, 5, 12 and 13 have also been amended in a similar fashion to comport with the amendments to independent claims 1 and 10. Accordingly, the rejections of claims 1-17 under 35 U.S.C. § 112, second paragraph, are believed to be resolved and withdrawal of this amendment is respectfully requested.

Claims 1 and 23 were rejected under 35 U.S.C. § 101 as allegedly lacking patentable utility and/or useful process. The Office Action states that "the claimed invention fails to carry out any interpolation process" and that "the claimed invention only carries out the generation of numbers (i.e., pixel values, geometric values, or differential values)." The rejection concludes that "the disclosed invention is inoperative and therefore lacks utility." The Applicants respectfully disagree for the following reasons.

First, the Applicants submit that, contrary to the assertions in the Office Action, the claimed features of claims 1 and 23 indeed effect and interpolation process. Although the Office Action asserts that the claimed invention only carries out the generation of numbers, interpolation is by definition a calculation process. For example, Webster's dictionary, tenth edition, defines interpolate to mean "to estimate values of a function between two non-values." The claimed methods in claims 1 and 23 actually claim the determination of a value for each of a plurality of pixels based on a vertex parameter value, a first geometric value and a second geometric value, this value being an interpolated pixel parameter value. Determination of this value was also, for example, discussed in paragraphs 28-31 of the present application. Accordingly, the assertion that disclosed invention is inoperative and lacks utility as a result is believed to be incorrect and this rejection should be withdrawn.

Applicants further note that § 2107.01, paragraph II provides directive on examination of inv ntions that are allegedly "inoperative." This section indicates that such situations where an inv ntion is found to be inoperative and lacking utility are rare. Thus, the Patent Office is cat ioned in this section to judicially apply this particular type of § 101 rejection to only those cas s where the claimed device must be totally incapable of achieving these for result. This is sin ›ly not the case in the present application. Quite the opposite, the disclosed and claimed me ıods indeed achieve the useful result of interpolating pixel parameters, which improve int› polating pixel parameter techniques by utilizing terms calculated during a set up mode du ng a calculation mode affording fewer computations and improved precision with a cor esponding improvement of processing speed and reduced overhead processing requirements ov‹ known prior interpolation pixel parameter techniques. Accordingly, the Applicants further sut nit that the rejection under § 101 is inappropriate and should be withdrawn.

The Office Action indicates that claims 2-17 would be allowable if rewritten or amended to vercome the rejections under 35 U.S.C. § 112, second paragraph. However, with respect to cla ns 2-9, it is unclear how these claims can be considered allowable when independent claim 1 fro ı which these claims depend was rejected lacking patentable utility. Nonetheless, with res ect to claims 10-17, these claims are believed to now be allowable due to the resolution of the 112 rejections.

Claims 18-22 were indicated as allowed. As the objection to claim 21 has been resolved, the Applicants agree that all of these claims should be allowed.

In light of the foregoing comments, the Applicants respectfully request reconsideration and withdrawal of the present rejections and that a timely Notice of Allowance be issued in this cas

Respectfully submitted,

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